working and with any accompanying thermal treatments are used to control certain properties and characteristics of the worked, or wrought, product or alloy.

In contrast to this, foundry products are made from casting alloys receiving their shape during the casting process itself and are not subsequently subjected to any kind of deformation process. At best the as-cast products are subjected to a thermal treatment to relieve any stresses present or to obtain any age hardening effects.

Thus, aluminium wrought alloys and cast alloys are different non-analogous metallurgical fields having their own niche and transforming the teaching of one field to the other field is not something the skilled person would do on a routine basis.

Further Applicants kindly direct the Examiner's attention to the enclosed page 70 of the well-known general textbook "**Aluminium Viewed from Within**" by Prof. Altenpohl, 1st edition, 1992 (ATTACHMENT I). This textbook represents common general knowledge for the skilled person in the art.

The second paragraph states:

"there is a basic difference in the strength properties between cast and wrought materials of similar composition".

Cast products, in particular die-cast products, are within the field of the present invention, whereas wrought products are within the field of several references the Office Action cites against the present claims. The Altenpohl text rebuts one of the Office action's arguments saying that since there is an overlap in composition, then substantially the same mechanical properties are expected to occur.

This second paragraph of Altenpohl explains the basic difference concerns the difference in elongation at rupture (=fracture), namely, wrought properties can withstand higher plastic deformation before rupture than a comparable cast structure. This basic difference is amongst others illustrated in Figure 63 of Altenpohl. In this Figure 63 one of the alloys compared in an AlMg3 alloy. Although the exact composition is not given, the fact that the aluminium alloy comprises about 3% of Mg makes it (closely) related to the alloy of the present invention having an Mg-content in the range of 3.0-4.5%. From this figure it can be seen that specific AlMg3 alloy when processed as a wrought product would have an elongation of about 15%, whereas when

processing it as a casting alloy by casting into a Permanent Mold (please note that permanent mould casting is closely related to die-casting, see the present specification on page 8, line 31-32) it would have a typical elongation of about 6-7%, which is less than about half the value of the same alloy as a wrought product.

Thus, where the inventors have found in accordance with the present invention that the claimed aluminium alloy exhibits a high level of elongation when die-cast (see page 5 line 16, and page 6 lines 5-6, and page 8 lines 9-10, and page 8 lines 21-23), this is for the skilled person, when using his common general knowledge, not at all an immediately apparent or evident result when starting from an aluminium wrought alloy having an overlap in compositional ranges.

B. The Elemental Compositions of the Alloys of EP '900 and JP '064 Are Too Different for Combining Their Teachings

JP '064 concerns an aluminium die-casting alloy having a Zn-content in the range of 1 to 3%, which is above the presently defined upper-limit of 0.9%. In addition JP '064 is fully silent about the possible addition of Zr as alloying element. Zr is an essential element in the present invention.

The problem solved by JP '064 is the providing of a die-casting alloy without requiring a solution treatment (see section [0003] of the translation). JP '064 teaches 1-3% Zn is required to improve fluidity (which is important in a casting operation) and it promotes precipitation hardening of Mg2Si and increases mechanical properties (it is assumed that strength is meant by this), see section [0012].

This section [0012] clearly and unambiguously teaches when the Zn-content is lower than 1% not only the elongation falls, but also the corrosion resistance deteriorates.

EP '900 concerns an AlMgMn-wrought alloy having a chemical composition broadly overlapping with the presently claimed range. The product is in the form of a plate having been thermo-mechanically processed (see page 2, lines 39-48, page 3, lines 28-50). EP '900 discloses that the Zn-content should be in the range of 0.4-5% (see claim 1), and preferably in a range of 0.4-1.5% (see claim 2) for the cases where the Mg is very high and in the range of 5.2-5.6%.

From a problem perspective EP '900 is directed to solving the problem of improving the strength compared to standard 5083 alloys, while having other properties such as corrosion resistance at least equivalent to standard 5083 alloys (see page 2 line 28-31).

The skilled person starting from EP '900 and being faced with the problem addressed by the present invention (see page 3 line 20 to page 4 line 4) will find <u>no</u> suggestion or hint in this document that the disclosed wrought alloy can be used in a die-casting operation (as rightfully observed by the Office Action) while achieving the present set of mechanical properties.

The Office action has the advantage of hindsight from knowing applicants' problem/solution. In impermissibly using this hindsight the Office action has now married the concept of the EP '900 composition to JP '064's disclosure which is impermissible. As mentioned above, wrought aluminium alloys and cast aluminium are non-analogous art, rather each have their own niche.

From a problem solution perspective and comparing it to applicants' problem / solution invention, the skilled person when starting from EP '900 would find no reason to combine this with the teaching of JP '064. JP '064 was solving the problem of providing a die-cast alloy without requiring a solution treatment. JP '064 neither teaches nor suggests reducing the Zn-content to levels lower than 0.9% and adding Zr to improve the elongation in the as-cast condition.

The combination of the teaching of EP '900 and JP '064, provided that there would be an allowable reason for this combination, would lead the skilled person towards a die-casting alloy having <u>more</u> than 1.0% of zinc in view of the teaching of JP '064. Furthermore, the skilled person would be led away from employing Zr because: (1) there is no teaching nor any suggestion in JP '064 that Zr could play any role in the die-casting alloy, (2) and the motivation of EP '900 to employ Zr is irrelevant to die-cast alloys. EP '900 teaches Zr might be added to achieve strength improvements in the work hardened tempers only, thus after mechanically working the product which is not carried out of die-cast alloy products. However, since die-cast alloys are due to their nature never subjected to mechanical deformation processing, the skilled person would seriously consider leaving out the Zr as alloying element. Thus, the combination of these two prior art documents would lead to a different die-casting alloy.

It is considered the inventive merit of the present inventors to explore die-casting alloys having less than 1% of zinc and to add Zr in a range of 0.05-0.25% to arrive at products in which very high and desirable elongation levels can be found. From Table 4 on page 12 of the present application it can be seen that the present invention has achieved elongation values of 23%,

which is significantly higher than the highest value presented in Table 1 of JP '064.

II. US-2001/0050118-A1 in view of JP-09-041064-A

Claims 17, 21, 23, 24, 26-39 and 42-51 are rejected under 35 USC 103(a) as being unpatentable over US-2001/0050118-A1 (US '118) in view of JP '064.

US '118 teaches an AlMgMn-wrought alloy having a chemical composition broadly overlapping with the presently claimed range. The product is in the form of various wrought shapes, which have all been thermo-mechanically processed (see section [0021] and [0023]). US '118 discloses a Zn-content of less than 0.4% and an optional presence of Zr up to 0.2% only.

US '118 is directed to the problem of improving the mechanical strength and fatigue resistance of welded structure (see section [0005]), and solves this problem by providing an alloy is the defined compositional range. In addition, in section [0021] it is emphasised that the improvement in mechanical strength depends both on the magnesium content in solid solution and on the manganese dispersoids, which should be kept above 1.2% volume percent. As is known to the skilled person and described in section [0032] this volume percent of manganese dispersoids is reached by pre-heating or homogenising the ingots to above 500°C for a defined period of time prior to hot rolling.

The processing steps of homogenisation and hot-rolling are <u>not</u> carried out when processing aluminium die-casting alloys.

The skilled person starting from US '118 and being faced with the problem addressed by the present invention (see page 3 line 20 to page 4 line 4) will find <u>no</u> suggestion or hint in this document that the disclosed wrought alloy can be used in a die-casting operation (as rightfully observed in the Office Action) while achieving the present set of mechanical properties.

The Office action has the advantage of hindsight from knowing applicants' problem/solution. In impermissibly using this hindsight the Office action has now married the US '118 composition to the JP '064 method of use. As mentioned above, wrought aluminium alloys and cast aluminium are non-analogous art, rather each have their own niche.

From a problem / solution perspective, and comparing it to applicants' problem / solution invention, the skilled person when starting from US '118 would find no reason to combine this with the teaching of JP '064. JP '064 was solving the problem of providing a die-cast alloy without requiring a solution treatment. JP '064 neither teaches nor suggests that, to improve the

elongation in the as-cast condition, the Zn-content has to be reduced to levels lower than 0.4% as taught by US '118. To the contrary, JP '064 teaches the skilled person the Zn levels of less than 1% are to be avoided when a drop in elongation is to be avoided (see section [0012] of JP '064). Thus, the references teach away from each other.

The combination of the teaching of US '118 and JP '064, provided that there would be an reason for this combination, would lead the skilled person towards an impractical product as the essential processing steps of pre-heating or homogenisation at temperatures above 500°C prior to hot rolling to obtain the Mn-dispersoids required to achieve the alleged improvements are processing steps which are not applied in manufacturing die-cast products.

III. WO-99/42627 in view of JP '064

Claims 17 and 23-51 are rejected under 35 USC §103(a) as being unpatentable over WO-99/42627 (WO '627) in view of JP-09-041064-A.

Applicant traverses this rejection with similar arguments as proposed above against EP '900 as WO '627 is also directed to AlMgMn-wrought alloys. The WO '627 wrought alloys have only an overlapping point at 4.5% Mg, being the lower-limit of the present claims. The product is in the form of a plate or extrusion having been thermo-mechanically processed (see page 1 lines 5-12, and page 9 lines 16 bridge page 10 line 9). From a problem perspective WO '627 is directed to solving the problem of improving the strength in the rolled or extruded product before and after welding, while having a formability at least equivalent to the standard AA5454 alloy (see page 5 lines 15-18).

The skilled person starting from WO '627 and being faced with the problem addressed by the present invention (see page 3 line 20 to page 4 line 4) will find no suggestion or hint in this document that the disclosed wrought alloy can be used in a die-casting operation (as rightfully observed by the Office Action) while achieving the present set of mechanical properties.

The Office action has the advantage of hindsight from knowing applicants' problem/solution. In impermissibly using this hindsight the Office action has now married the WO '627 composition to the JP '064 method of use. As mentioned above wrought aluminium alloys and cast aluminium are non-analogous art, rather each have their own niche.

From a problem / solution perspective, and comparing it to applicants' problem / solution invention, the skilled person when starting from WO '627 would find no reason to combine this with the teaching of JP '064. JP '064 was solving the problem of providing a die-cast alloy without requiring a solution treatment. There is no teaching nor any suggestion in JP '064 that to improve the elongation in the as-cast condition the Zn-content has to be reduced to levels lower than 0.9% and that Zr should be added as is subject of the present claims.

The combination of the teaching of WO '627 and JP '064, provided there would be an reason for this combination, would lead the skilled person towards a die-casting alloy having more than 1.0% of zinc in view of the teaching of JP '064 and less than 4.5% Mg in view of WO '627. Furthermore, although WO '627 teaches to add Zr in a wrought alloy, the skilled person would leave out the Zr in a die casting alloy because there is no teaching or suggestion in JP '064 that Zr could play any role in the die-casting alloy. Thus the combination of these two prior art documents would lead to a completely different die-casting alloy.

IV. Conclusion

In view of the above, it is respectfully submitted that all rejections are overcome. Thus, a Notice of Allowance is respectfully requested.

Respectfully submitted,

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ATTACHMENT I

Prof. Altenpohl, "**Aluminium Viewed from Within**" 1st edition, page 70 (1992)

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Aluminum Viewed from Within

An Introduction into the Metallurgy of Aluminum Fabrication

1st Edition

Prof. D. Altenpohl

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Alloys with silicon and copper additions in which the Si plus Cu varies between 6 and 13% also exhibit good castability. Alloys of this group are usually produced from scrap using exacting remelting and refining techniques. Large quantities of these alloys are widely used for standard products.

There is a basic difference in the strength properties between cast and wrought materials of similar composition. An example of this is shown in Figure 63. The yield strength and hardness are comparable for the cast and wrought structures with the hardness even somewhat higher in the casting. On the other hand the better formability of the wrought structure is manifested in a higher elongation at rupture and a correspondingly higher tensile strength. In general a wrought structure withstands higher plastic deformation before rupture than a comparable cast structure. This difference comes into play if, for example, a structural part can be produced as a casting, forging or from sheet. All of these parts may be designed to fit the load requirements for a specific application. However, the higher formability proves favorable in the case of shock-type overload. In such a case the designer must decide whether the component should fail by rupture or if it should deform and, then write the specification for elongation and toughness accordingly.

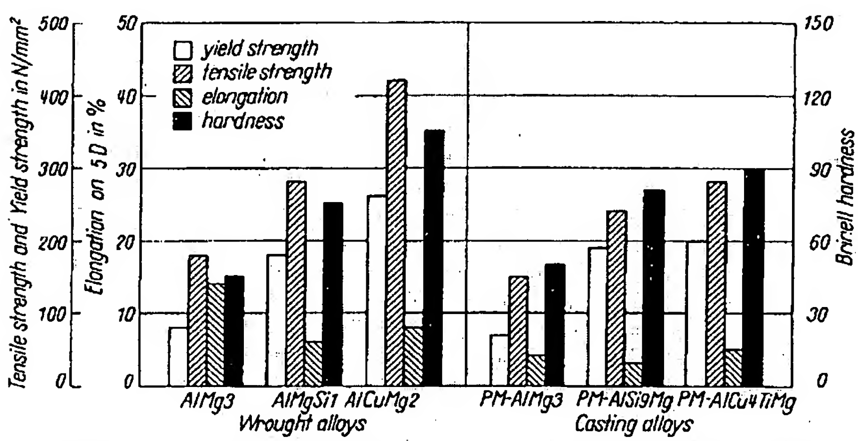

Figure 63: Comparison of mechanical data for forged and cast parts. PM = Permanent Mold.

Melting and Casting (Quality Requirements)

For the production of quality castings a clean melt is required regardless of the casting technique employed. The most important measures are:

- Careful selection of the input metal,
- Careful temperature control during the entire melting process,
- Removal of nonmetallic impurities (oxides, nitrides),
- Maintenance of an optimum gas content,